PATENT SPECIFICATION

(11) **1 570 492**

(21) Application No. 47149/75 (23) Complete Specification file

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(22) Filed 15 Nov. 1975

(23) Complete Specification filed 14 Dec. 1976 (44) Complete Specification published 2 July 1980

(51) INT CL3 A01N 59/00 37/16 A61L 2/18

(52) Index at acceptance

A5E 101 247 274 501 512 B P A5G 13 14 5B 5D 5G

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(54) STERILIZATION OF ARTICLES

(71) We, METAL BOX LIMITED, of Queens House, Forbury Road, Reading RG1 3JH, Berkshire, a British Company, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the sterilization of articles. In particular, but not exclusively, the invention relates to the sterilization of plastics containers for later filling with a sterile food product such as a soup.

It is well known in aseptic filling lines to use plastics containers and to sterilize them by means of an aqueous solution of hydrogen peroxide (H₂O₂) applied at a concentration of about 30% and at a temperature in excess of 80°C. Such relatively high concentrations and temperatures are needed to effect the rapid rate of sterilization demanded of modern aseptic packaging lines.

The solution is applied as a spray beneath which the containers are moved on a conveyor. From the spray the containers pass to a bank of blowers by which sterile hot air is directed onto them to evaporate or drive off the sterilizing agent together with the water in which it is dissolved. The containers accordingly leave the blower bank dry and in a sterile condition, and in this state are passed to the filling station of the machine for filling with metered quantites of sterile food product as desired, and for later closing and sealing with a sterile diaphragm.

It is also known to employ an aqueous solution of peracetic acid (CH₃CO OOH) as a sterilizing medium, in either wash or spray form. The acid is used in a concentration of between 1% and 2% and at a temperature generally within the range 40°C to 50°C. The use of temperatures higher than this tends to be counterproductive because of the substantial volatilisation of the acid which then occurs.

Throughout the Specification and Claims the concentrations given for peracetic acid or hydrogen peroxide are in weight of the sterilizing agent by volume of the aqueous solution in which they are dissolved. The term "concentration" should be construed accordingly.

According to the present invention from one aspect there is provided a method of sterilizing an article or a part thereof, in which the article is subjected to a sterilizing medium comprising hydrogen peroxide and peracetic acid in aqueous solution, the concentration of the peracetic acid lying within the range 0.01% to 0.5%.

This provision of peracetic acid in a concentration which is substantially smaller than the concentrations employed when the acid is used alone has been found to increase the effectiveness of hydrogen peroxide solution to a marked extent. Without any sacrifice of sterilizing efficiency it thereby enables the concentration of the hydrogen peroxide to be substantially reduced, so not only reducing material costs but also facilitating the later removal of the sterilizing medium. Additionally or alternatively it enables the use of shorter exposure, and hence process times, or the use of lower sterilizing temperatures, the latter being a particularly important desideratum where the articles to be sterilized are particularly sensitive to elevated temperatures.

It is hoped that the concentration of the peracetic acid may be sufficiently low to substantially reduce or avoid the unpleasantness, corrosive effect, and safety hazard attendant upon the use of peracetic acid in the concentrations used hitherto, so that the advantage described above are not substantially negated by counteracting disadvantages.

From a second aspect the invention provides apparatus for sterilizing articles,

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	1.	2.	3.	4.	
	T. (60)		30.2% hydrogen	30.2% hydrogen peroxide+0.1%	
	Temp. (°C)	Time (Sec)	peroxide	peracetic acid	
45	65	2	uncountable	uncountable	45
		4	uncountable	25—80	
		7	uncountable	nil	
		12	5—32	nil—21	
	75	2	uncountable	nil—7	
55		$\bar{4}$	uncountable	nil—1	50
		Ż	nil—35	nil—2	
		12	nil—16	nil	
	85	2	104-430	nil3	
	05	4			
		4	20—94	nil	
		7	10—25	nil	55
		12	66138	nil	
		12	66138	nil	

From a comparison of columns 3 and 4 of each table it will be seen that the presence of 0.1% peracetic acid significantly reduces the survival rate of the spores; in both tables, in fact, the survival rate when peracetic acid is used is zero or negligible for all but the shortest exposure times and temperatures. Whereas there is a significant increase in failure rate if the hydrogen peroxide concentration is reduced from 30.2% to 20.4% when the peracetic acid is absent, this is not so if the

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7. A method of sterilizing an article, substantially as herein described.

peracetic acid having a concentration lying within the range 0.01% to 0.5%.

the articles by the spray means and subsequently, after sterilization has taken place,

to drive off the hydrogen peroxide and peracetic acid and the water in which they

6. A sterilizing medium for a method as claimed in any one of Claims 1 to 4, comprising, in aqueous solution, hydrogen peroxide and peracetic acid, the

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are dissolved.